Spring 2017

Kaiser Permanente Anaheim ED Improving Patient Flow Using Systems Engineering & Lean Thinking

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KAISER PERMANENTE (KP) ANAHEIM ED IMPROVING PATIENT FLOW USING SYSTEMS ENGINEERING & LEAN THINKING

HSE Capstone Project
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PRESENTATION OVERVIEW

1. Background
2. Stakeholder Needs
3. System Requirements
4. Statistics for ED department
5. Current State and Future State Process Maps
6. Implementation Methods
7. Risk Analysis
8. Business Case
9. Lean Improvements Table
10. Conclusion

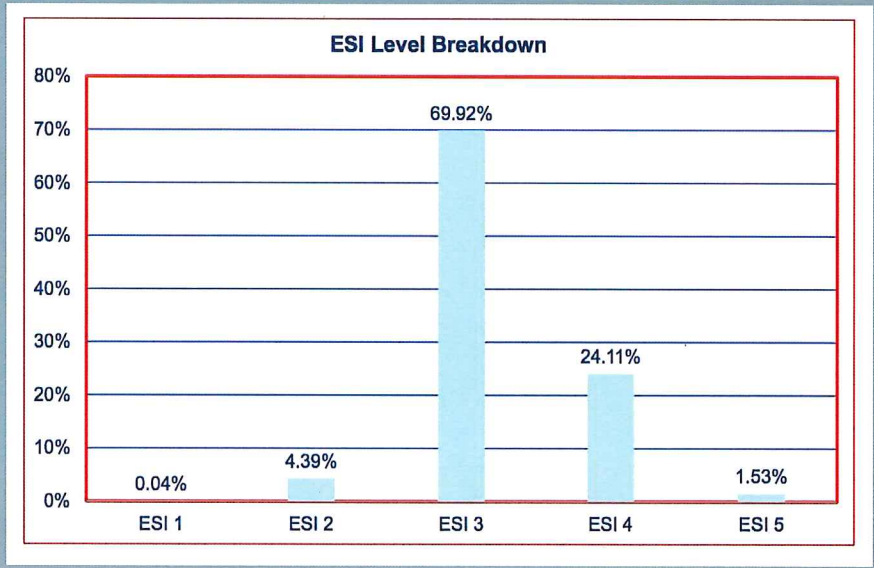
BACKGROUND

- **EMTALA ACT (Emergency Medical Treatment and Labor Act)** - a federal law passed in 1986 that requires anyone coming to an emergency department to be seen by a physician, stabilized and treated, regardless of their insurance status or ability to pay.

- **Emergency care** - "Life- or limb-threatening condition, chest pain, severe shortness of breath, sudden slurred speech or inability to move, active labor, complicated medical history."

- **Urgent care** - "Sore throat and upper respiratory symptoms, earaches, coughs, backaches, headaches/migraines, bladder infections/urinary tract infections."

Kaiser Permanente, Los Angeles Medical Center

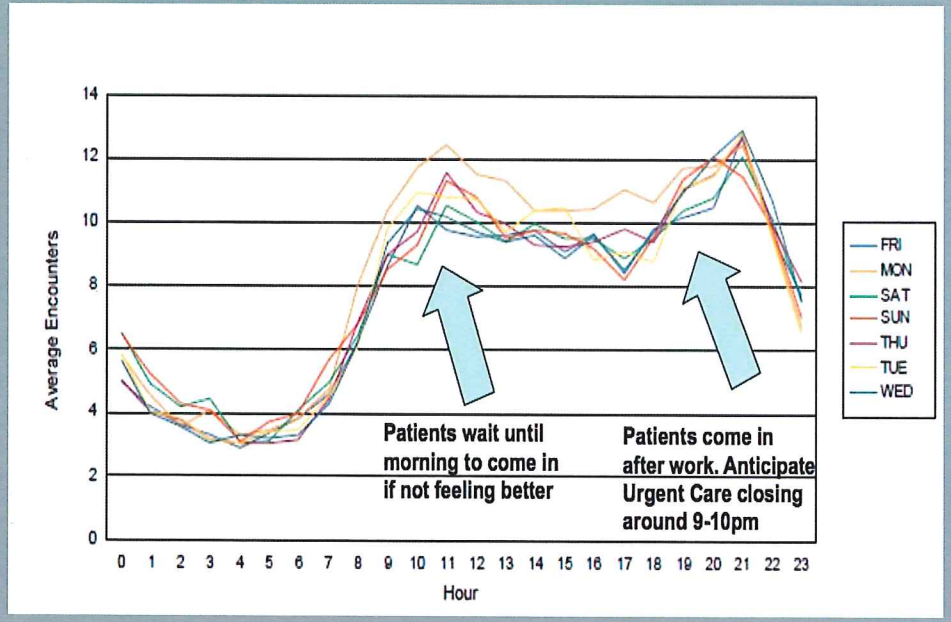


Emergency Severity Index

- ESI 1 - actively performing CPR
- ESI 2- psych or stroke
- ESI 3 - abdominal pain or chest pain
- ESI 4 - cold
- ESI 5- prescription refills

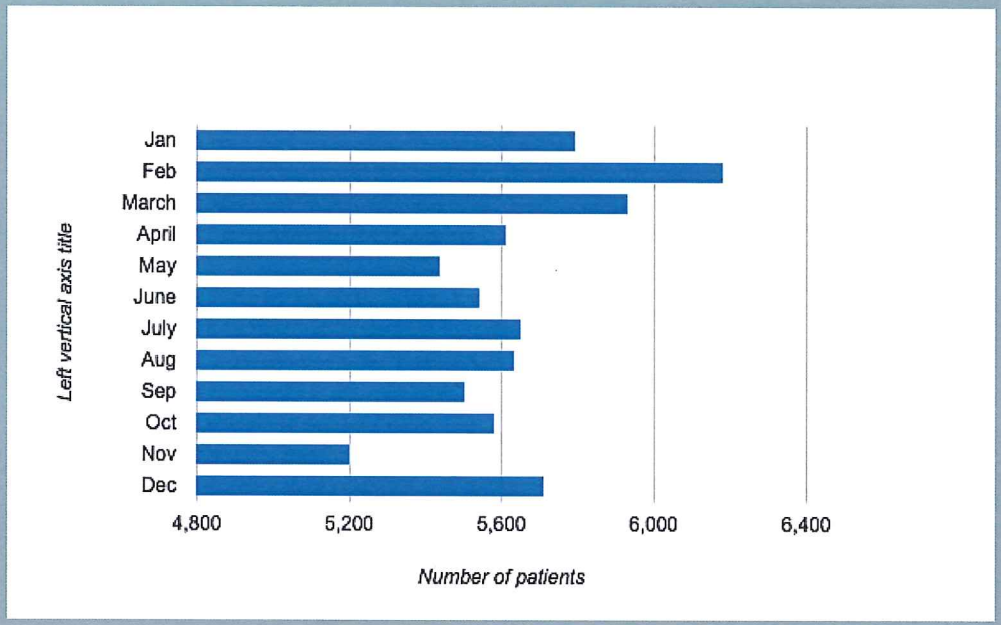
Typical Breakdown Los Angeles 2016, Cecilia Militante

ARRIVALS TO THE ED



By hour in LA KP - consistent trend to Anaheim & other EDs (specific stats for Anaheim not retrieved)

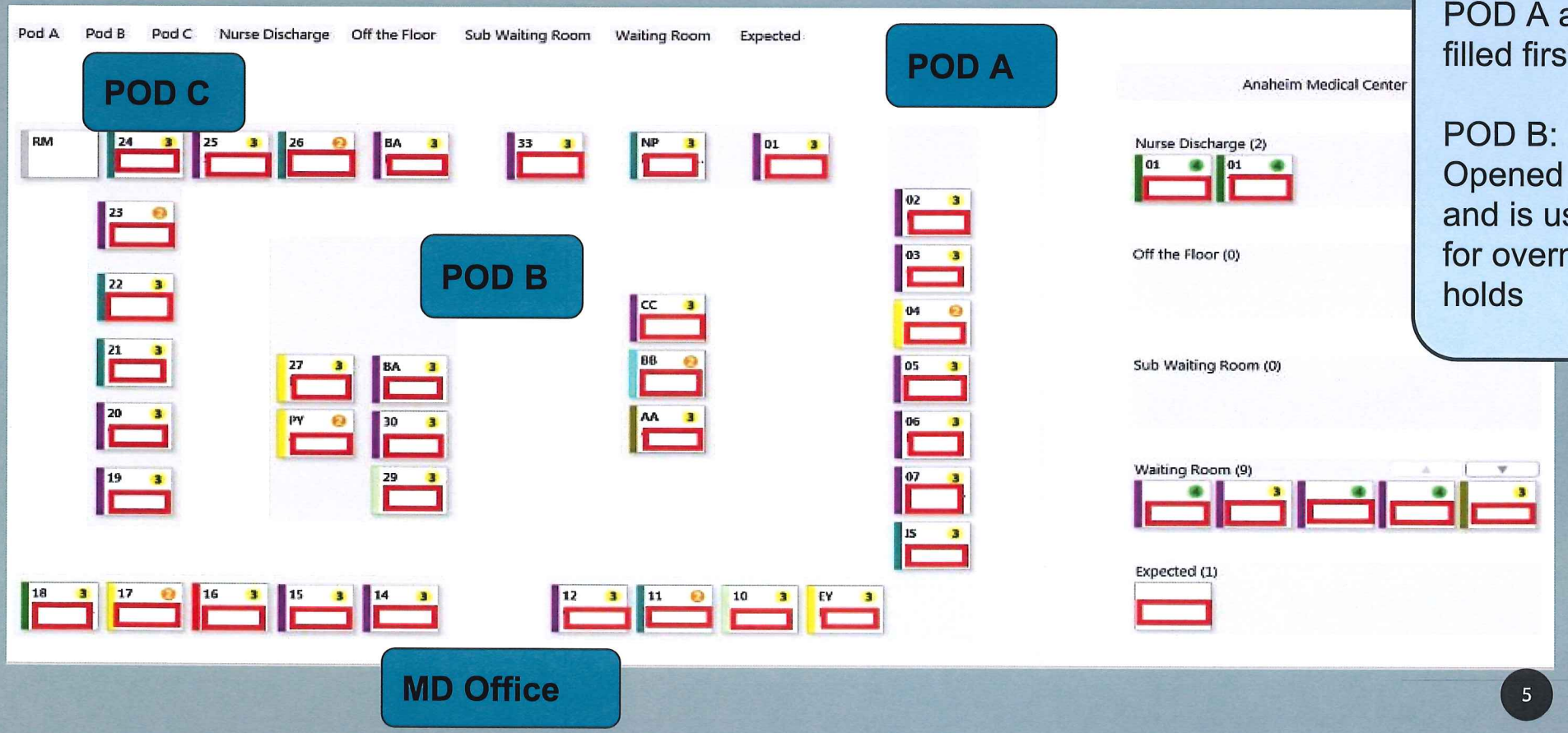
Cecilia Militante, Area Lab Manager, Los Angeles Region, 2016.



Arrivals by month in Anaheim

Michelle Datwyler, Orange County Region, 2016.

MAP OF KP ANAHEIM ED

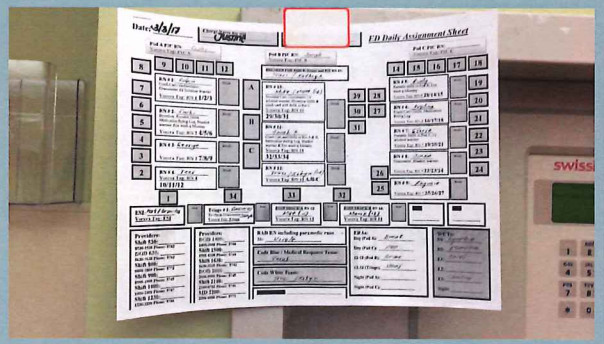


POD A and C filled first

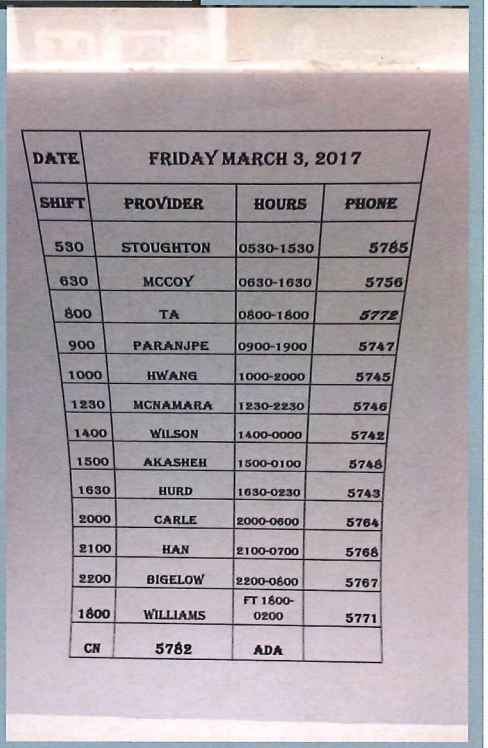
POD B: Opened last and is usually for overnight holds

ANAHEIM ED STAFF

Staff	Averages
Physicians	13 - 14 (throughout day) + 1 MD as pit-shift from 12pm-10pm
Nurses	14- 20 (full capacity shift)
Charge Nurse	1 (per shift)
ED Techs	3 - 4 (per each shift)
EVS	1 (per shift)
Social Work	1 (part - time)
Case Manager	1 (staffed 24 hours)



Nurses staff per day



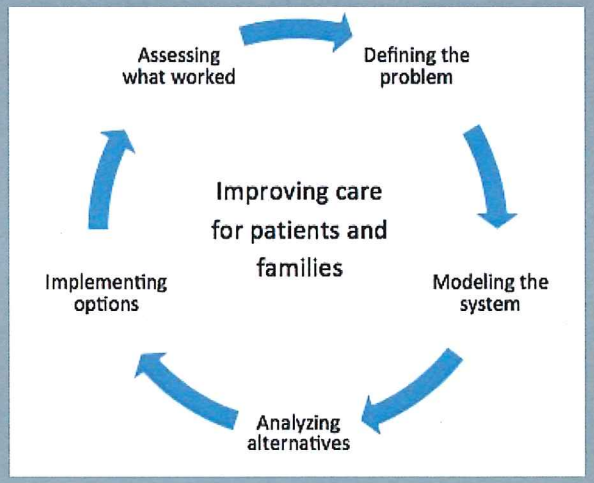
DATE	FRIDAY MARCH 3, 2017		
SHIFT	PROVIDER	HOURS	PHONE
530	STOUGHTON	0530-1530	5765
630	MCCOY	0630-1630	5756
800	TA	0800-1800	5772
900	PARANJPE	0900-1900	5747
1000	HWANG	1000-2000	5745
1230	MCNAMARA	1230-2230	5746
1400	WILSON	1400-0000	5742
1500	AKASHEH	1500-0100	5748
1630	HURD	1630-0230	5743
2000	CARLE	2000-0600	5764
2100	HAN	2100-0700	5768
2200	BIGELOW	2200-0600	5767
1600	WILLIAMS	FT 1600-0200	5771
CN	5782	ADA	

Physician staff per day

PROJECT GOAL

Use systems engineering and Lean methodologies to improve the ED patient flow and align with KP's mission statement of improving patient's health outcomes.

KP Mission Statement: "To provide affordable, quality health care services and to improve the health of our members and the communities we serve."

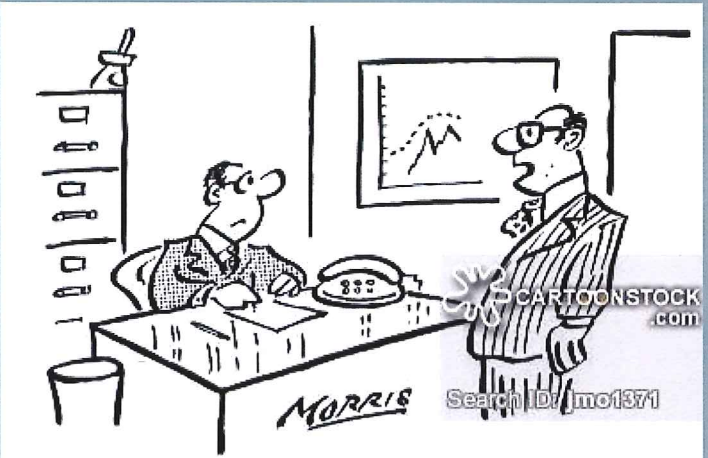


PROBLEM STATEMENT

KP Anaheim Emergency Department is a relatively large facility with **67,798 visits last year** alone. Due to the Affordable Care Act, the volume of patients keeps increasing. With an increasing number of patients, there is an ongoing continuous need for quality improvements and efficiency. There are both urgent and non-urgent inflows of patients within the ED and thus contributing to constant variability. There is a high amount of waste that not only impacts the department's flow but also patient care.

CURRENT ANAHEIM ED CHALLENGES

1. Inadequate staffing
2. Inaccurate triage
3. Excessive handoffs
4. Imaging and radiology waiting
5. Waiting for hospitalists & specialty physicians
6. Waiting for available inpatient beds
7. Unreasonable patient demands
8. Unjustified ED readmits
9. Satisfactory patient tracking
10. Stock inventory



"By the way, while you were off sick yesterday we located the bottleneck."

INTERROGATIVES & STAKEHOLDER NEEDS

WHO? (Stakeholders)

- Patients & Families
- Medical Professionals & Staff
- Kaiser Permanente Administration

WHAT?

Streamlining Anaheim ED

WHERE?

Kaiser Permanente Anaheim

HOW?

System Engineering and Lean Methodology

WHEN?

Now

Patient Needs (Key stakeholders)

1. Efficiency
2. Timeliness
3. Individualized
4. No defects and waste
5. Transparency
6. Inclusive of latest technology
7. Favorable outcomes
8. Affordability
9. Accessibility

Kaiser Permanente Southern California's Values-

1. Quality
2. Service
3. Results
4. Integrity
5. Partnership
6. Diversity
7. Accountability
8. Flexibility
9. Innovation

Jeffrey Weisz. *It's a Great Time to Be a Physician.*

SYSTEM REQUIREMENTS & VERIFICATION

Requirements	Verification Method
The system shall **minimize overall time** of patients in ED.	Test & Analysis
The system shall **minimize waste** in the ED processes.	Analysis
The system shall **improve the staff morale.**	Confidential Survey
Increasing value or health outcomes achieved per dollar spent to deliver higher quality healthcare.	Analysis

GEMBA WALK (9am - 2pm)

Patient Case	Bottleneck	Waiting in bottleneck
1. Shortness of breath	Rad - x-ray	10:16am - 10:56am = 40 mins (Order placed to results complete)
2. Abdominal Pain	Rad -Ultrasound	9:20am - 11:11am = 111 mins (Order placed to results complete)
3. Cholecystitis	Consult for surgery	11:24am - 1:21pm = 117 mins (Order for consult until consult saw patient)
4. Fall	Rad - x-ray	11:44am - 1:00pm = 86 mins (Order placed to results received)
5. Shortness of breath	Rad - x-ray	12:20pm - 1:30 pm = 70 mins (Order placed to results received)
6. Chest pain	Waiting on admitting physician	10:30am - 12:25pm = 115 mins (Order for admit MD to order to admit pt)
7. Nausea / vomiting	Rad - contrast CT	10:00am - 12:25pm (Order placed to transferred to CT)
8. Vaginal bleeding	None - Ultrasound done beside by Dr. Ghobadi	Total process 52 minutes
9. Altered level of consciousness	Labs & Rad	Lab - 11:20am-12:35 pm= 75 mins Rad- 11:20am - 1:15pm = 115 mins (Labs sent to lab & order placed to results received)
10. Tachycardia	Rad - x-ray	9:45am- 11:15am = 90 mins (Order placed to results received)

Emergency Department Throughput Dashboard

Jan to Dec 2016	FO	ONT	RI	MV	LA	WLA	OC-AH	OC-IV	SD	BP	DW	SB	PC	WH	Tot/Avg/ Mdn[4]	Target
Volume and Staffing																
Total Visits	96,642	56,994	49,232	43,401	78,214	75,000	67,798	45,378	105,967	84,199	101,230	65,012	67,914	43,508	980,489	
Member Visits per 1000 Members per month	14.0	20.3	10.8	29.5	14.4	20.8	15.9	14.5	13.4	19.0	19.3	18.3	17.0	15.9	17.4	
% Admits	13.9	14.3	16.5	8.5	16.8	11.1	15.3	17.5	17.1	13.7	15.0	15.7	14.2	16.7	14.7	
% Fast Track Visits[1]	32.5	27.0	32.2	42.2	23.5	28.0	26.4	22.0	19.6	32.7	21.9	23.6	31.1	25.5	27.7	
% Non-Member Visit Rate	36.0	21.8	19.0	39.6	29.6	32.6	10.5	9.1	7.7	24.6	18.3	19.2	26.4	18.3	22.3	
% Non-Member Admit Rate	18.9	13.2	7.5	11.9	10.2	11.4	6.1	3.0	3.6	6.0	8.7	7.5	7.7	6.0	8.7	
Capacity (# Patients/ED Treatment Bay Annualized)	1853.5	1536.2	1534.3	3607.0	1368.5	1411.3	1878.2	1223.1	1761.3	2153.1	1577.4	1507.8	1992.1	1607.1	1,786	
Adjusted MD & Extender FTEs per 1000 visits[2, 3]	4.9		5.4		5.1	5.8	5.0		7.5	5.8	6.4	5.9	5.3	5.5	5.7	
Direct MD & Extender FTEs per 1000 visits	4.0		4.3		4.3	4.5	4.0		5.2	4.6	5.2	4.5	4.2	4.3	4.4	
Patients per provider-hour (direct hours only)	1.58		1.45		1.46	1.39	1.57		1.21	1.37	1.21	1.38	1.48	1.47	1.42	
RN FTEs per 1000 visits[3]	15.5	15.4	15.5	11.7	14.9	13.0	12.7	14.5	17.3	14.2	16.6	16.4	13.2	17.6	14.9	
Ancillary FTEs per 1000 visits[3]	5.6	7.2	8.2	4.2	9.7	6.9	4.5	5.2	10.8	6.9	7.3	7.7	6.0	5.5	6.8	
ED Throughput																
% Patients with Arrival to Provider <= 30 min	50.7	51.1	71.2	92.0	66.0	65.7	71.6	71.1	49.2	56.2	52.8	61.4	64.8	55.1	63.1	
% Patients with Arrival to Provider <= 45 min	62.3	62.7	83.2	96.3	83.1	78.1	84.6	88.0	59.2	72.3	61.2	72.2	80.9	71.9	75.2	82.0
Door to Provider all Patients	0:52	0:50	0:29	0:10	0:29	0:34	0:35	0:28	1:03	0:39	1:08	0:40	0:31	0:37	0:36	0:30
Door to Roomed all Patients	0:50	0:41	0:18	0:52	0:23	0:31	0:16	0:09	1:01	0:29	0:19	0:31	0:24	0:23	0:27	0:25
ED LOS for non-admits (Door to Discharge)	4:18	4:03	3:08	2:54	3:13	4:17	2:51	2:46	5:30	3:08	5:18	4:29	3:21	3:38	3:30	
Disposition Home to RN Discharge for non-admits	0:40	0:36	0:23	0:06	0:32	0:31	0:13	0:08	0:37	0:29	0:19	0:38	0:26	0:23	0:28	
Door to Decision-to-Admit	5:14	4:38	3:56	4:21	5:06	5:13	3:53	3:43	6:57	4:39	5:37	5:12	3:53	4:57	4:48	
ED LOS for Category 4 & 5 (Fast Track Patients)	2:00	1:53	1:37	1:45	1:38	2:00	1:35	1:11	2:24	1:50	2:34	2:14	1:45	2:08	1:52	1:40
% Patients LWBS & ELOP, and AMA	7.4	5.6	2.7	3.1	2.7	4.9	2.0	1.0	4.5	2.7	8.9	4.5	2.1	3.6	3.4	3%
Divert Hours					278:15	131:36	13:36	2:55	238:49	301:45	195:59	65:37	139:08	80:10	144:47	
% ASQ overall ED Satisfaction Results (>/= 9)	65.8	66.4	70.8	68.3	72.7	65.8	69.8	70.1	62.4	72.2	62.6	69.5	70.2	69.8	69.6	
% ASQ overall ED Satisfaction Results (>/= 8)	75.6	78.6	78.0	77.9	82.0	77.0	80.0	81.4	73.7	81.3	73.3	79.1	81.6	81.3	78.8	84.0
% ASQ Consistent Messaging Results (patient kept informed of how long the treatment would take)	58.8	67.9	64.9	61.6	66.4	60.9	68.6	71.6	56.8	66.1	60.0	65.0	66.0	62.0	65.0	67.0
ASQ Mean Wait Time to See Provider	7.7	8.0	8.4	8.3	8.5	7.9	8.3	8.4	7.4	8.3	7.2	8.0	8.1	8.1	8.0	8.25
Hospital Throughput																
Medicine Consult Turnaround Time	1:47	1:33	1:19	1:16	2:37	1:49	1:15	1:17	3:01	2:23	1:42	1:49	1:05	1:47	1:48	
Admits Median Time from Admit Order to ED Depart	2:50	1:50	1:30	0:57	2:08	1:14	1:36	1:40	2:30	1:33	2:02	1:28	1:20	1:41	1:38	1:00
Admits Median Time from Door To ED Depart	8:20	6:30	5:22	5:05	7:20	6:09	5:31	5:28	9:19	5:58	6:56	6:19	5:00	6:23	6:14	
Average Daily Boarding Time	122:11	40:18	26:34	4:33	76:18	13:38	37:31	41:54	147:17	30:54	75:44	39:17	21:51	22:26	50:41	
Lab and Diagnostic Imaging Turnaround Time																
CBC w diff (Average min)	56	47	45	58	33	40	39	29	41	40	60	44	40	35	40	45
Electrolytes (Average min)	67	52	48	61	46	45	45	34	56	45	68	59	43	43	47	45
Troponin (Average min)	75	59	54	67	49	55	51	42	60	54	72	68	53	51	54	60
Portable Chest X-Ray Exams/1000 visits	164.1	165.5	213.3	185.9	136.2	198.2	175.6	192.4	177.3	142.7	246.7	219.4	146.1	246.9	181.6	
Portable Chest X-Ray (Median min)	35	28	24	28	28	30	23	20	29	26	36	32	28	25	28	30
CT Head Exams/1000 visits	79.1	88.7	77.6	84.3	76.7	89.1	72.6	74.0	104.6	75.7	94.7	72.7	70.4	101.5	78.3	
CT Head (Median min)	42	37	39	35	48	38	47	50	64	38	52	68	38	44	43	60

Monthly Dashboards are distributed around the 25th of the month for the previous month and the year-to-date.

[1]Fast Track Patients are Emergency Severity Index (ESI) categories 4 and 5.

[2]MD and MD-Extender FTEs are calculated with MD-Extender hours at a rate of 0.6

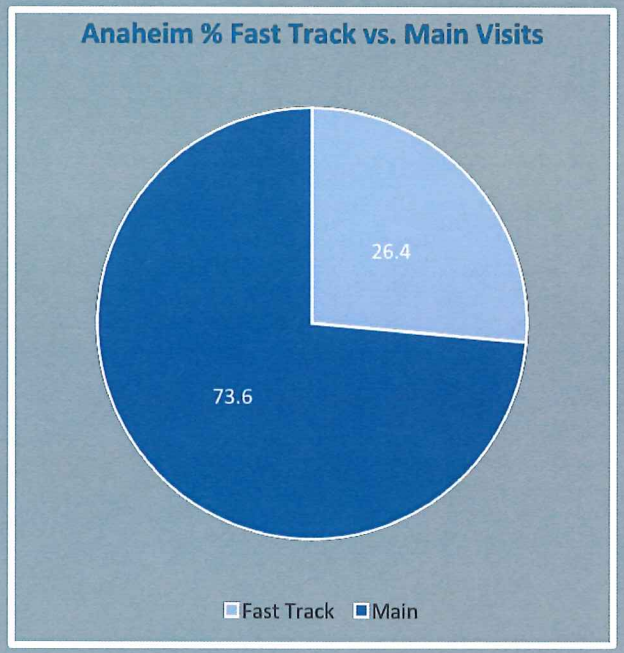
[3]MD, MD-Extender, RN, and Ancillary FTEs include direct and indirect hours. RN FTEs do not include travelers/registry.

[4]These are the average or median of the aggregated values for each ED location. Please see "Measure Definitions" for more

Source Interview Report ED Scorecard; Michelle Datwyler, 2016

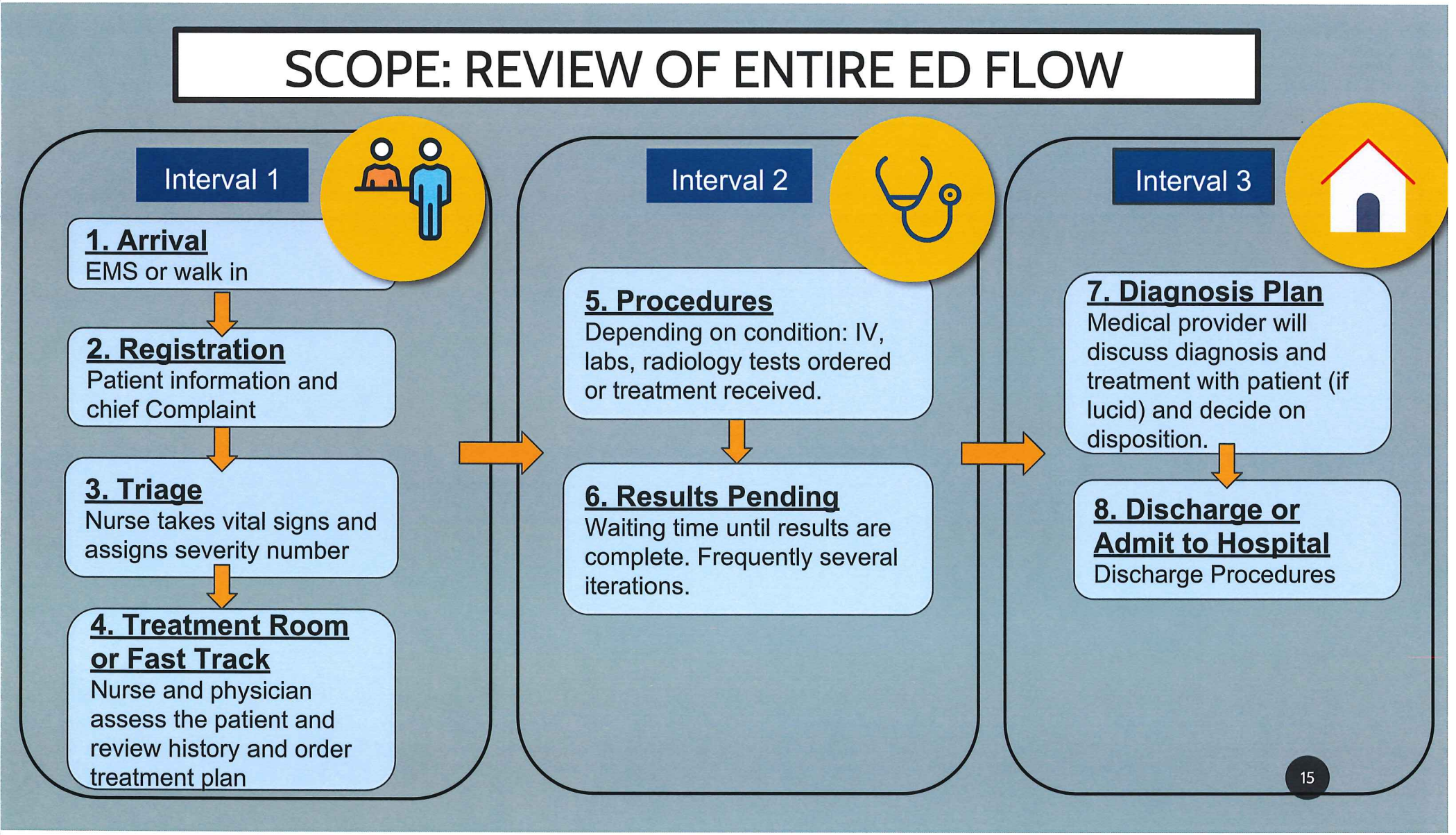
ED THROUGHPUT DASHBOARD - 2016 - VOLUME

Metrics for 2016	Anaheim	Southern CA
Total visits	67,798	980,489
% admits to hospital	15.3	14.7
% fast tracks	26.4	27.7
% non member visits	10.5	22.3
% patients AMA (Against medical advice), LWBS(left without being seen), or eloped	2.0	3.4
% ASQ Overall Satisfaction Results (> / = 8)	80.0	78.8
Total # of ED beds in PODs A, B, C	36	N/A
In-Patient number of beds	262	N/A



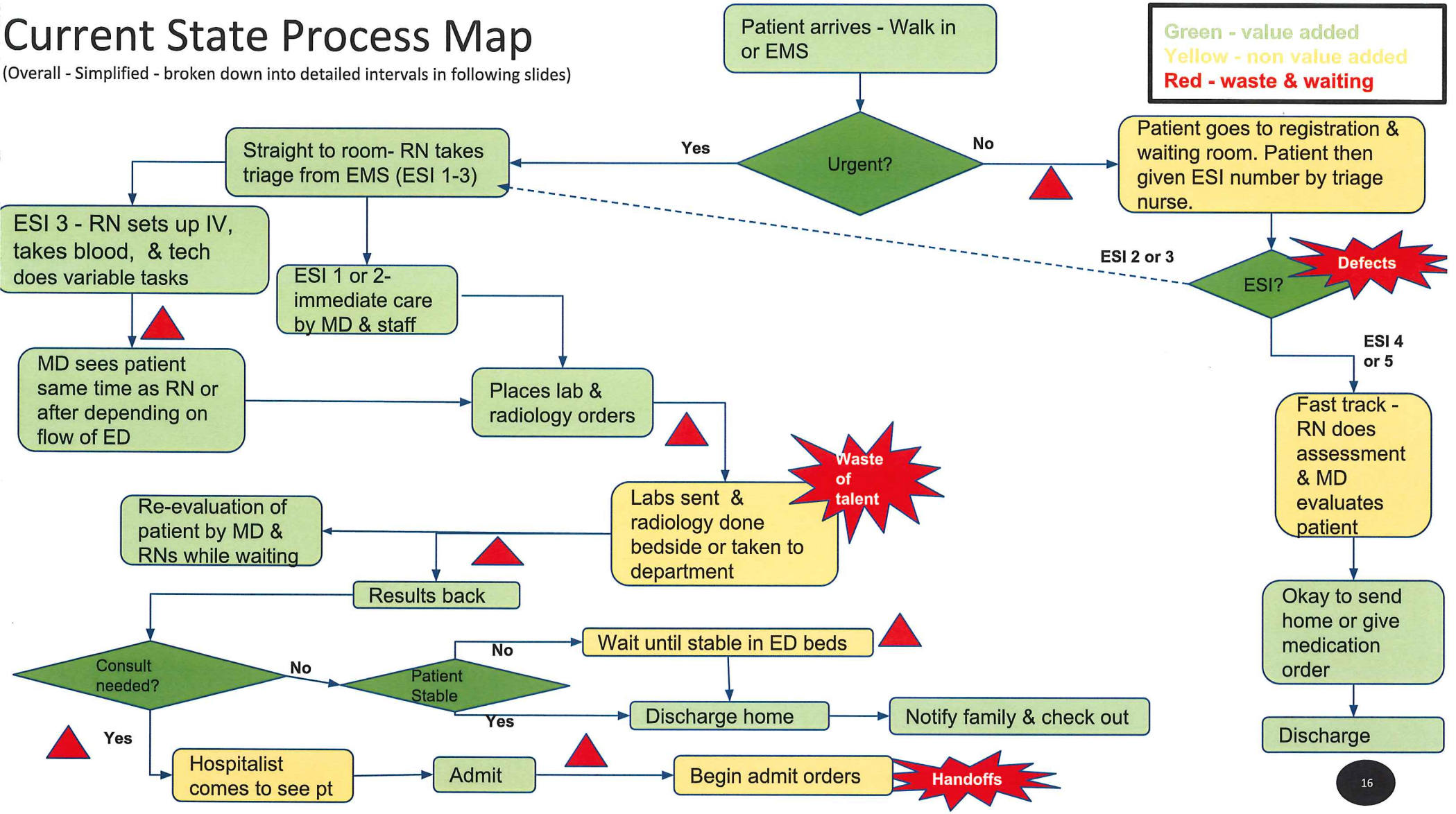
Interview Report ED Scorecard, Michelle Datwyler, Orange County Region, 2016.

SCOPE: REVIEW OF ENTIRE ED FLOW

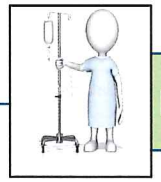


Current State Process Map

(Overall - Simplified - broken down into detailed intervals in following slides)



Interval 1: Arrival to Physician - Current State



Patient Arrives in ED

EMS

Walk In

Triage: Critical Patient?

Yes

No

Is main bed available?

No

Yes

Waiting

Waiting room

2

Patient Registers with RN

RN assesses patient & assigns ESI

1

ESI 3 or above

ESI 4 /5

Patient directed to main

Main beds - sometimes remain in gurney if no beds

Patient is moved to main bed. Nurse gives assessment and orders. MD may also be present depending on ED volume. ERA (ER tech) takes EKG or wound care. Ward clerk assigns physician to bed.

3, 4

Is fast track open?

No (12pm-12am)

Yes

Patient directed to fast track (6 total beds)

6

Remains in Waiting room

Is FT bed open?

No

Yes

Patient assigned to FT bed

Waste of Talent

Has blood been taken by phlebotomist on duty?

No

Yes

Nurse inserts IV, and takes blood work.

3,5

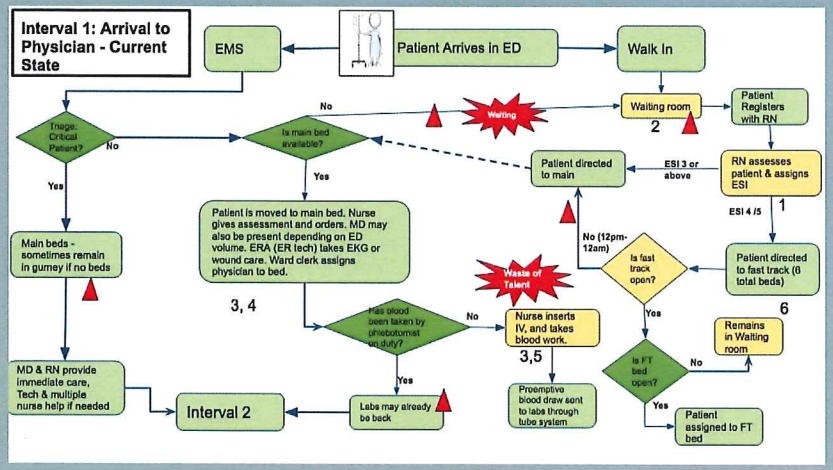
Preemptive blood draw sent to labs through tube system

MD & RN provide immediate care, Tech & multiple nurse help if needed

Interval 2

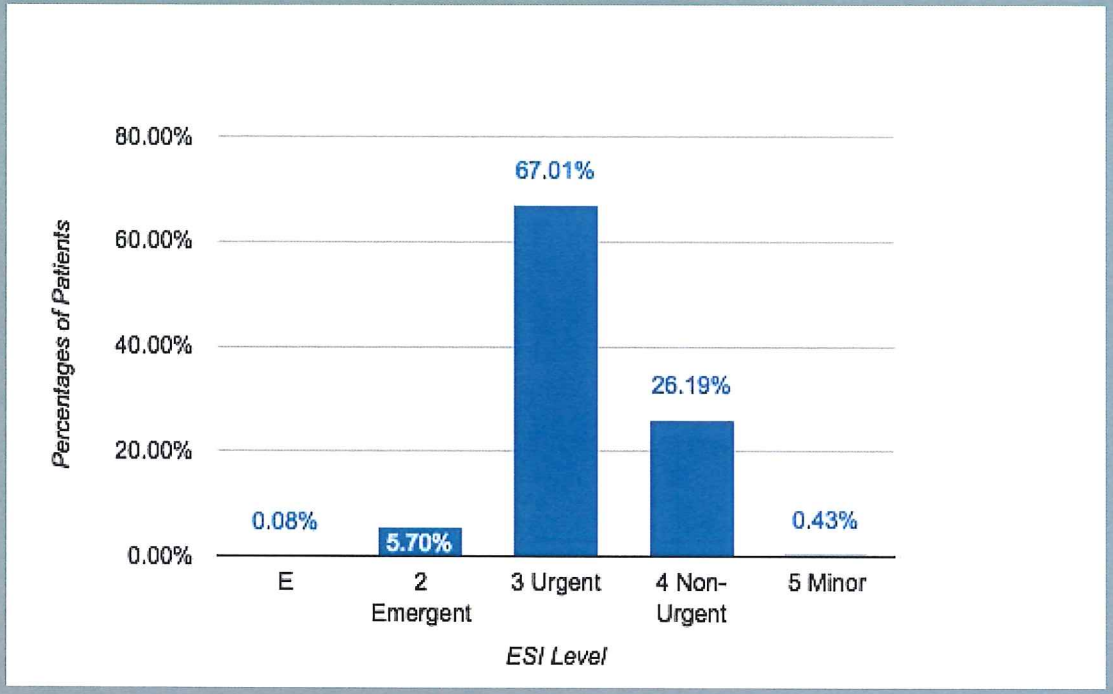
Labs may already be back

WASTE IN INTERVAL 1



#	Waste Category	Waste
1	Defects	Inaccurate triage - patient placed in fast track and needs to be moved to main
2	Waiting	Waiting for open fast track or main bed
3	Waiting	Patients waiting for assessment or treatment
4	Muri	Nurses feeling overburdened with tasks
5	Waste of Talent	Nurse taking blood instead of phlebotomist
6	Defect	ESI 5 moved back to fast track or main beds

ED TOTAL ESI NUMBERS FOR 2016

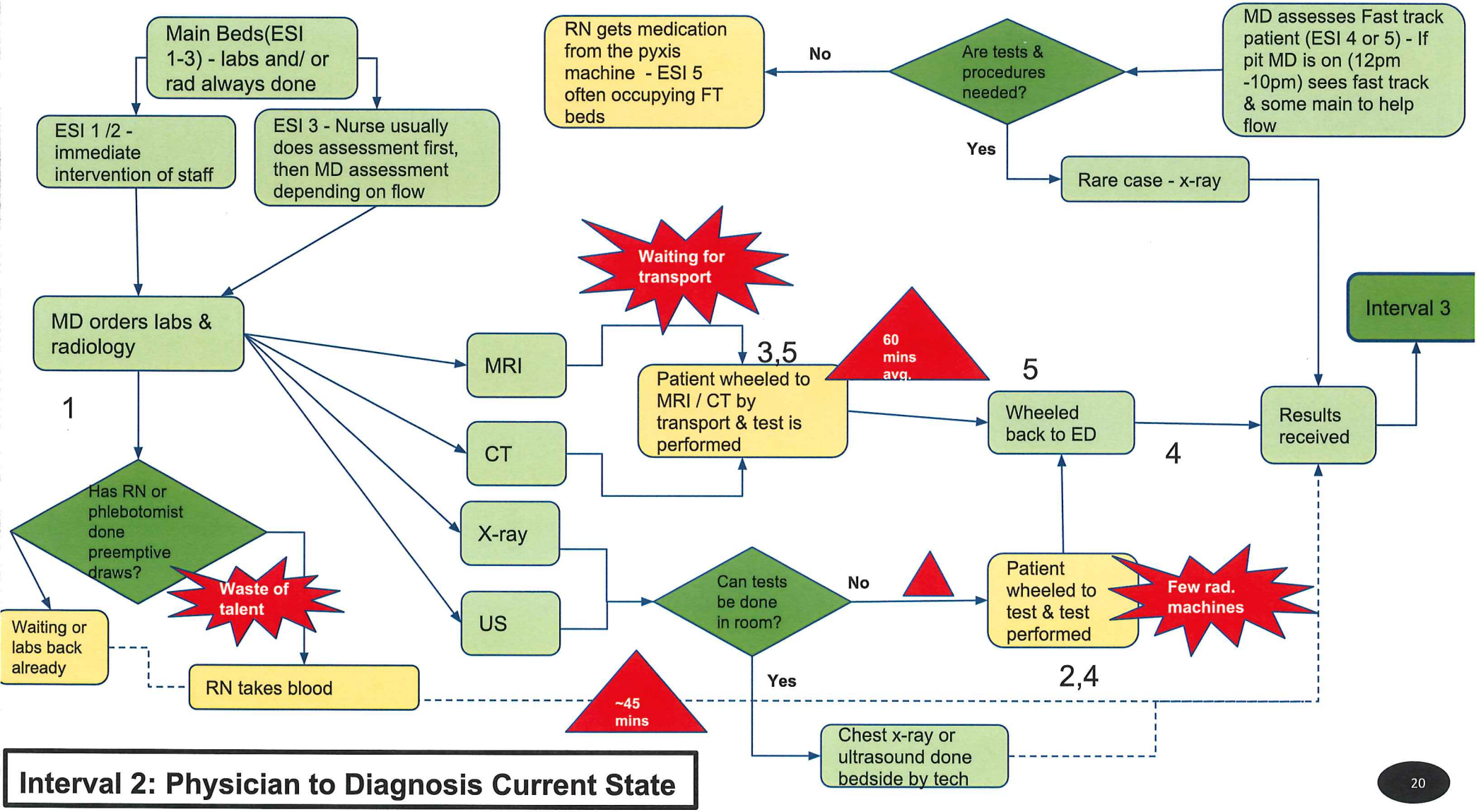


Approximate Costs of ED Visits

ESI LEVEL	Current Cost/ Patient	Current Cost / year
5	$186	$126,926
4	$849	$14,449,432
3	$2,751	$121,776,053
2	$4,585	$24,978,521
1	$6,239	$2,124,434

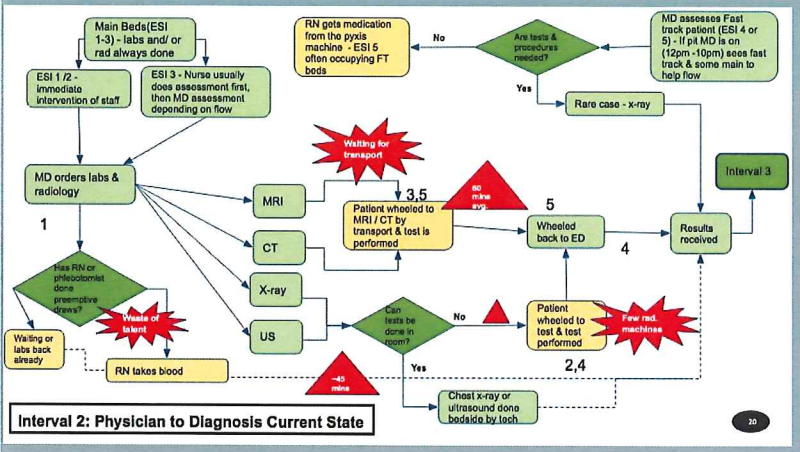
Michelle Datwyler, Anaheim, 2016.

Cecilia Militante, Area Lab Manager, Los Angeles Region, 2016.



Interval 2: Physician to Diagnosis Current State

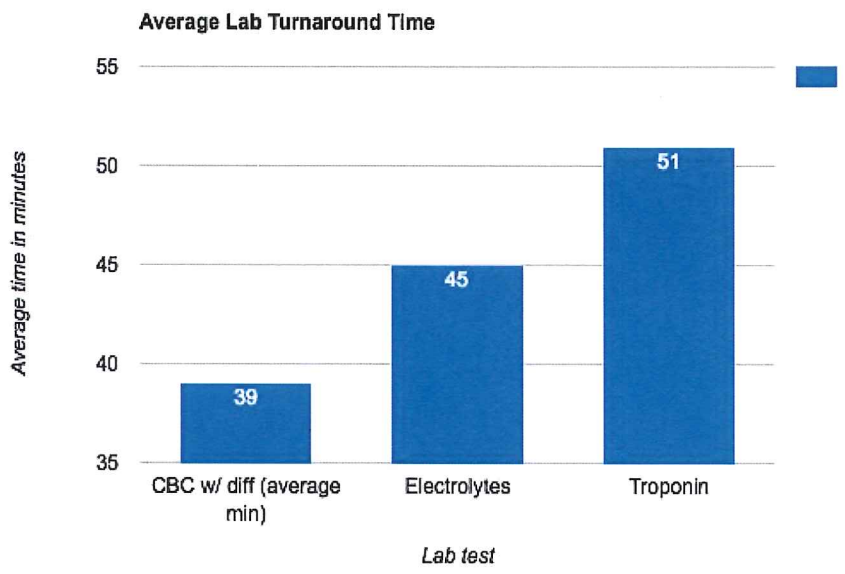
WASTE IN INTERVAL 2



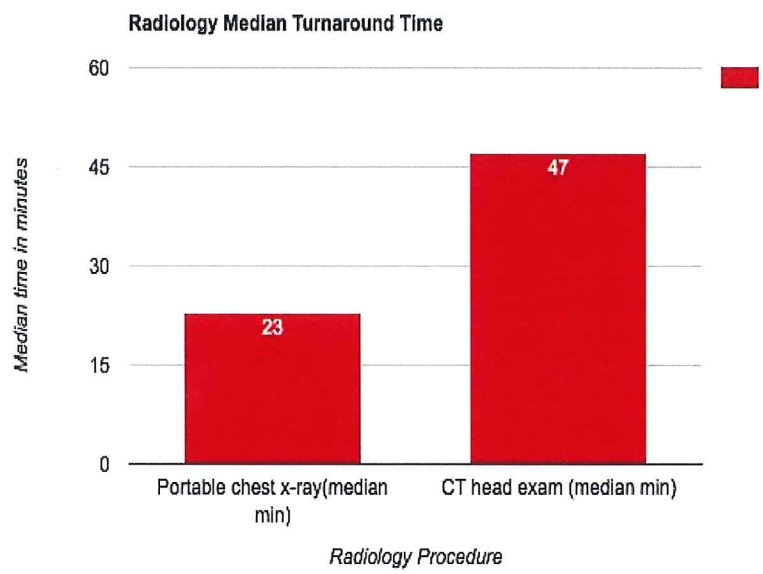
#	Waste Category	Waste
1	Muri	Physician may order excessive tests on patients for patient satisfaction
2	Inventory	Too few radiology machines for patients
3.	Waiting	Physicians waiting for laboratory or radiology test results.
4.	Waste of talent	RNs and MDs constantly having to check patient's status
5.	Waste of talent	Radiology techs transporting patients back and forth to radiology department

DIAGNOSTIC TURNAROUND TIMES

Laboratory
(Order by Physician to Completion)

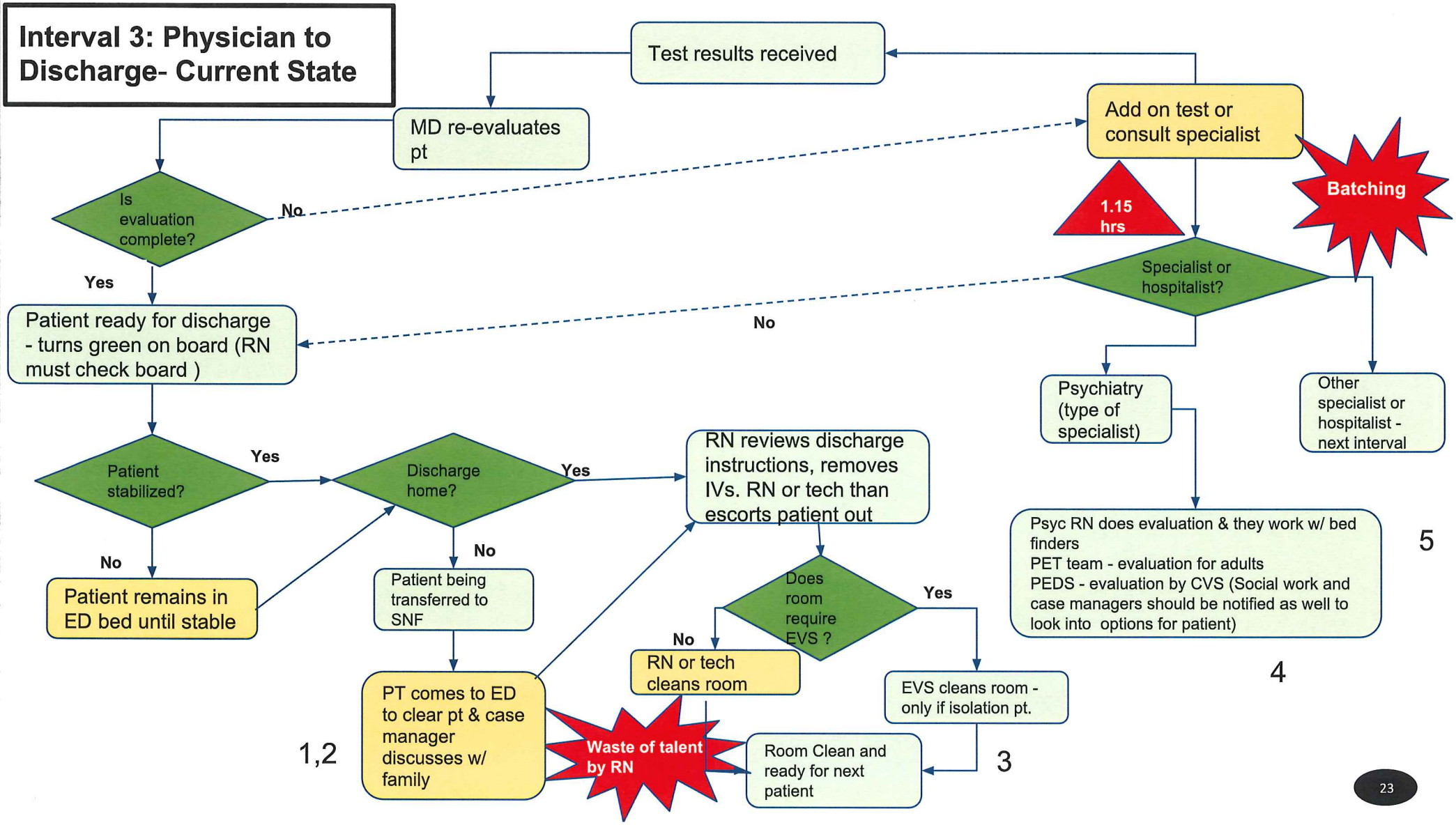


Radiology
(Order by Physician to Completion)

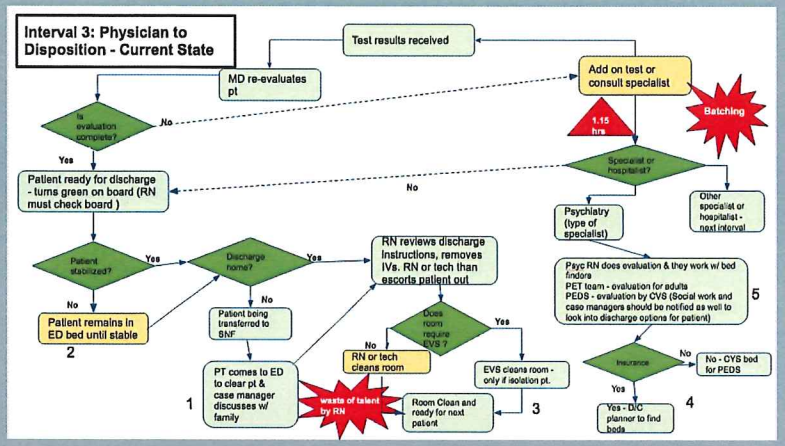


Source Interview Report ED Scorecard, Michelle Datwyler, Anaheim, 2016.

Interval 3: Physician to Discharge- Current State



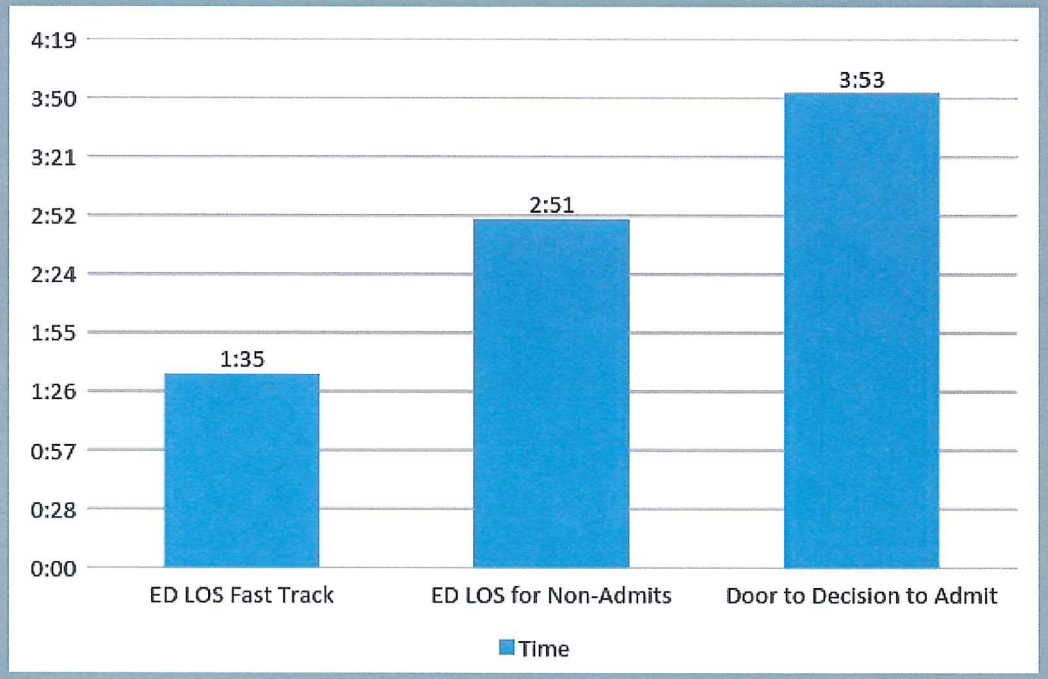
WASTE IN INTERVAL 3



#	Waste Category	Waste
1.	Waiting	Waiting on PT to assess patient in ED for SNF approval
2.	Waiting	Case Manager waiting on family or waiting to find placement for patient.
3.	Waste of Talent	EVS only does full room clean if isolation patient
4	Mura	Psychiatric patients taking beds for days at a time (5150- 72 hours)
5	Muri	Social workers feel that they are not being used enough thus resulting in chronic homelessness and unidentifiable psychiatric illnesses.

AVERAGE LENGTH OF STAY IN ED

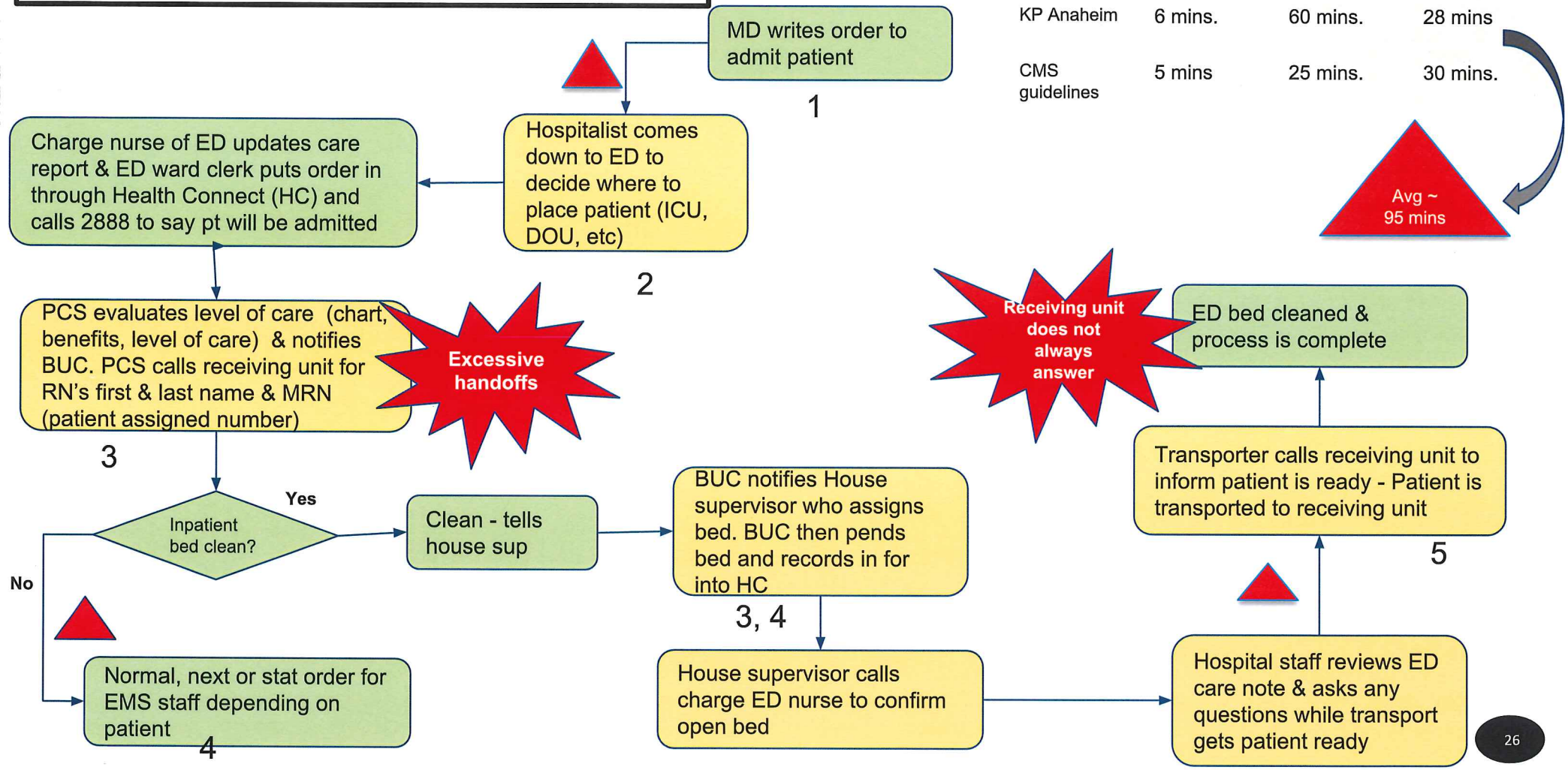
Metric	Time
ED LOS Fast Track	1:35
ED LOS for Non-Admits	2:51
Door to Decision to Admit	3:53



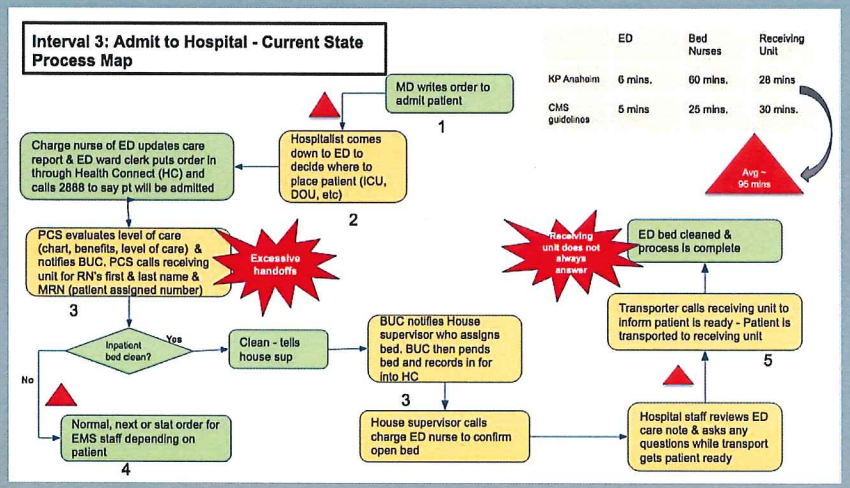
Source Interview Report ED Scorecard, Michelle Datwyler, Anaheim, 2016.

Interval 3: Physician to Admit to Hospital - Current State

	ED	Bed Nurses	Receiving Unit
KP Anaheim	6 mins.	60 mins.	28 mins
CMS guidelines	5 mins	25 mins.	30 mins.



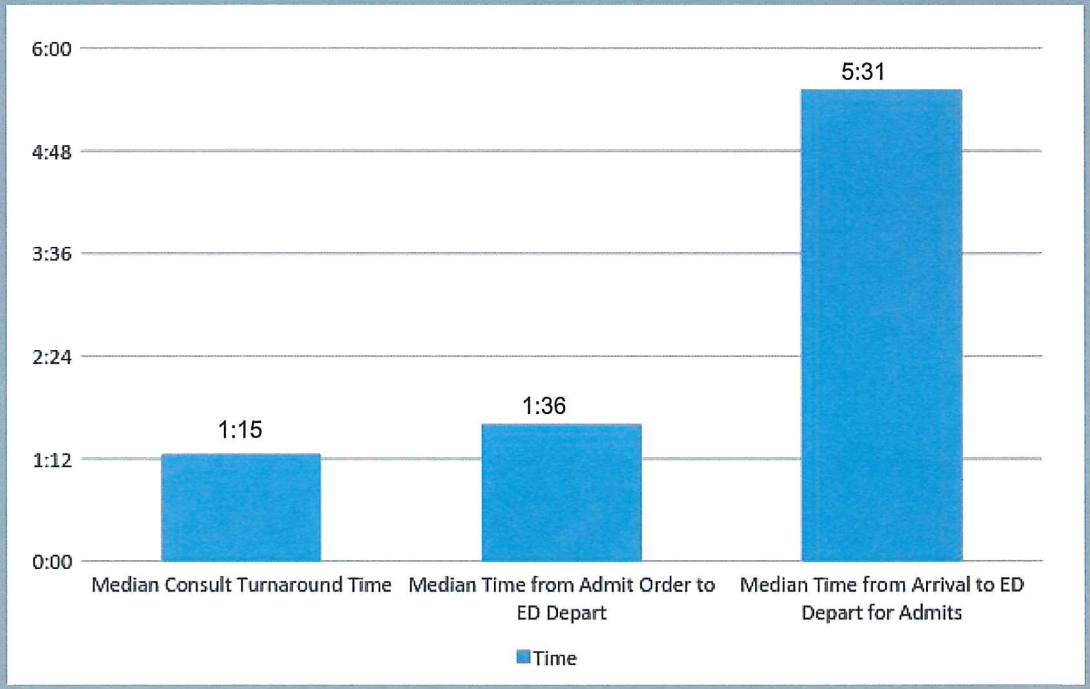
WASTE IN INTERVAL 3 (ADMIT)



#	Waste Category	Waste
1	Waiting	Waiting on hospitalist or specialist to come down
2.	Batching	Hospitalist batching patients in ED
3.	Muri	Excessive handoffs between BUC, house supervisor, PCS, and charge nurses
4.	Staffing	EVS staff (1 person) from ED often sent upstairs to clean admit beds
5.	Waiting	Waiting for receiving end bed unit to answer phone

ED HOSPITAL THROUGHPUT FOR ADMITS

Metric	Time
Median Consult Turnaround Time	1:15
Median Time from Admit Order to ED Depart	1:36
Median Time from Arrival to ED Depart for Admits	5:31



Source Interview Report ED Scorecard, Michelle Datwyler, Anaheim, 2016.

IDEAS FOR FUTURE STATE

Interval 1:

- Physician up in triage with RN
- ESI 1 automatic admit – process for admit starts immediately
- ESI 4 & 5: open fast track 24/7
- Phlebotomist staffed in ED 24/7
- ESI 5 sent back to waiting room or home

Interval 2:

- Use transporters rather than radiology techs to move patient to radiology
- Train transporters to priortize patients for radiology
- Notify transporters in real time of orders
- Modern Visual Controls systems with patient tracking
- 24/7 phlebotomist in ED

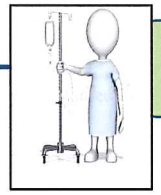
Interval 3: (Discharge)

- Use transporters rather than RN to transport patient out
- Notify transporters in real time
- Use discharge lounge for all patients
- Have EVS clean room rather than nurse or ED tech within minutes of patient departure, use immediate signaling

Interval 3: (Admit)

- Hospitalist makes decision to admit patient from ER screens upstairs unless absolutely necessary
- Eliminate handoffs between house supervisor, PCS, BUN and charge nurses
- Addtional EVS at peak hours
- Call EVS in real time

Interval 1: Future State



Patient Arrives in ED

EMS

Walk In

Waiting room

Patient Registers with RN

RN assesses patient with physician in screening room & assigns ESI

ESI 1

ESI 2&3

ESI 4

ESI 5

Immediate care for patient & automatic admit processes should be started.

Patient directed to fast track (6 total beds) - open 24/7

Patient send directly home or sent to discharge lounge or waiting room for medication refill

Critical Patient?

Yes

No

Is main bed available?

Yes

No

Patient directed to main

Main beds - sometimes hallway bed may be necessary

Patient is moved to main bed. Nurse gives second assessment. ERA may do EKG or wound care. Doctor may also be present depending on ED volume. (Ward clerk assigns bed to physician)

MD & RN provide immediate care. Tech & multiple nurse help if needed

Phlebotomist on duty 24/7 takes preemptive blood draws from patient

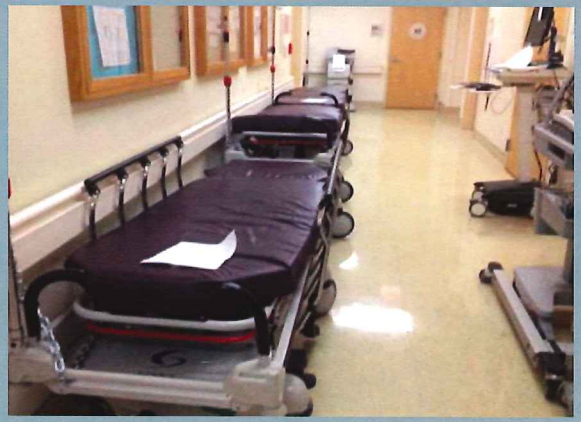
Interval 2

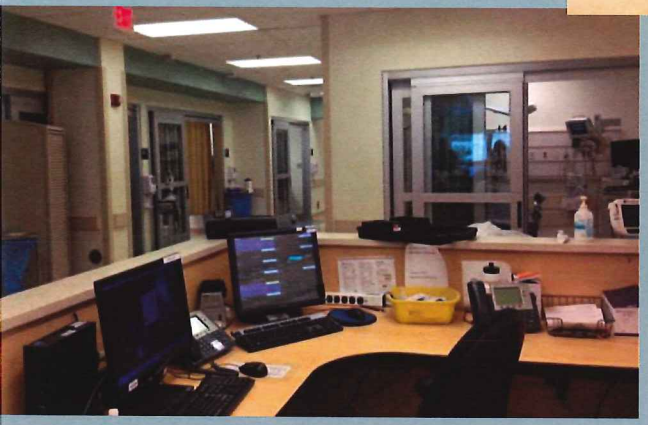
INTERVAL 1

Front Desk Triage

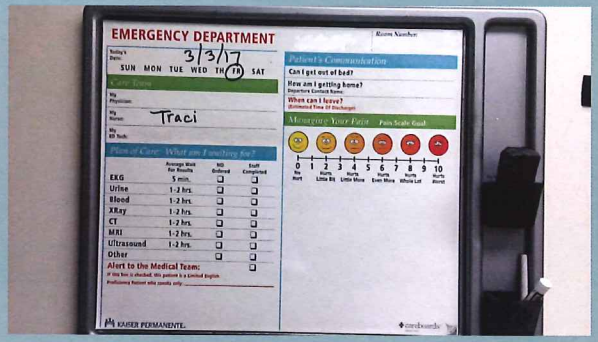
Carts with emergency supplies

Hallway Beds





Nurses Stations



Patient Room Boards

IDEAS FOR FUTURE STATE

Interval 1:

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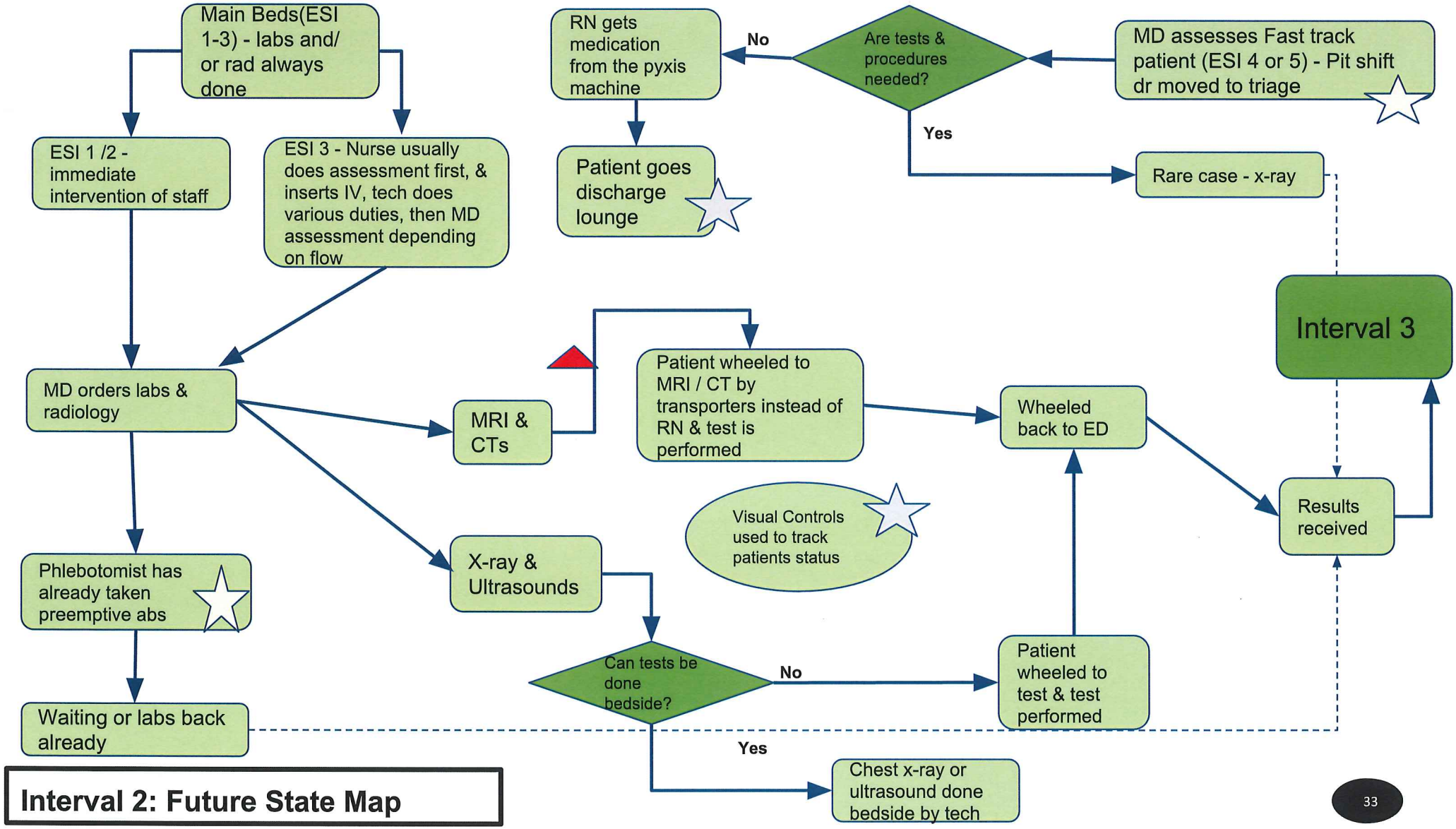
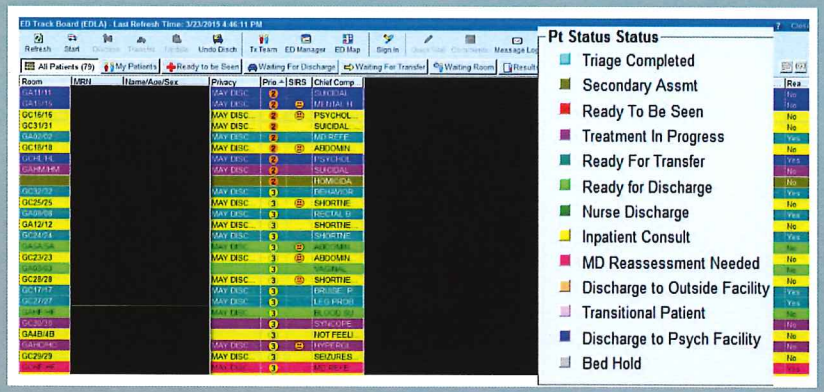


Interval 2: Future State Map

INTERVAL 2

Portable Radiology Machine



Visual control boards with up to date patient status

Bedside ultrasound

Phlebotomists Drawing blood for patient's labs 24/7

CT machine

IDEAS FOR FUTURE STATE

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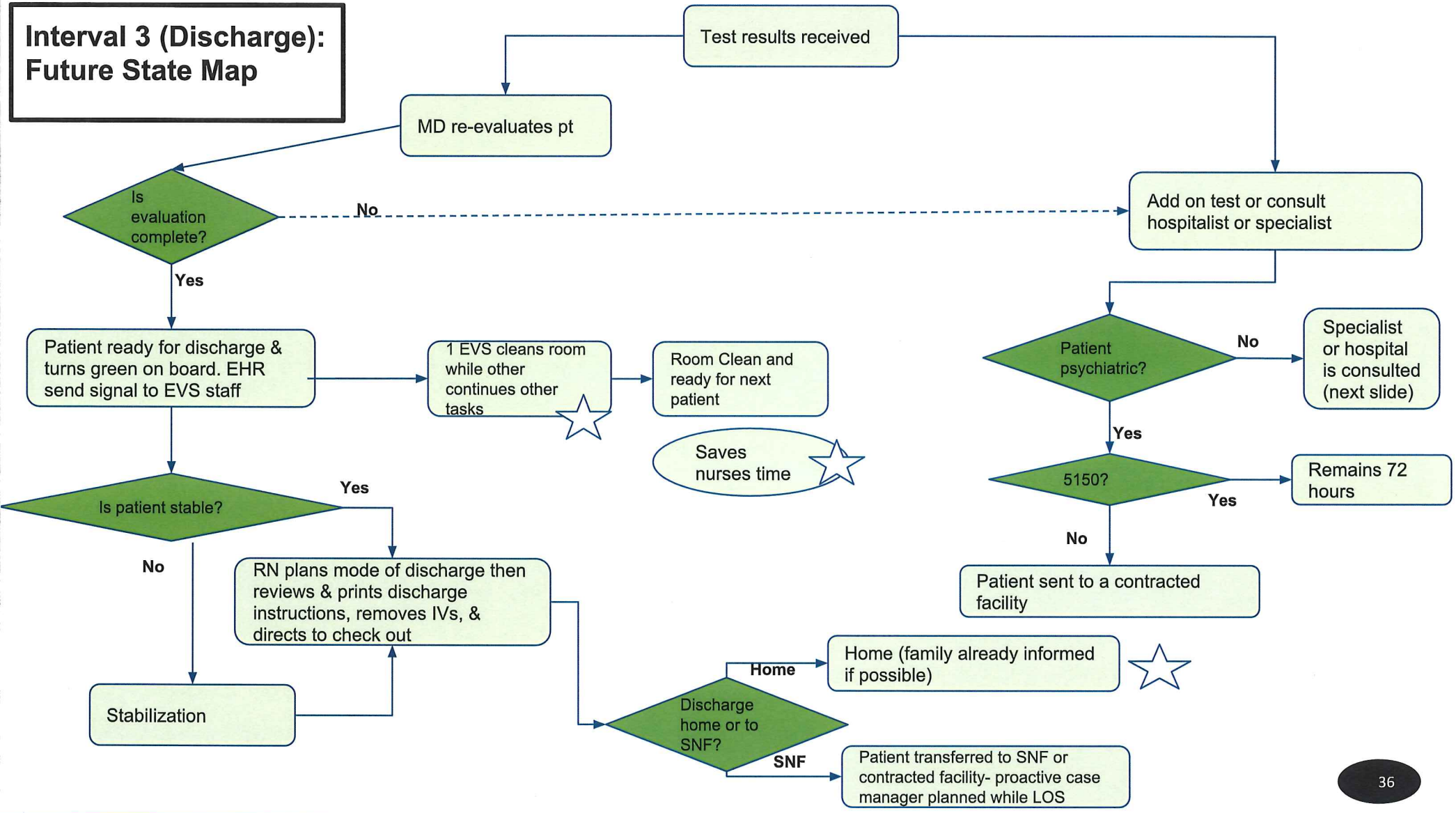
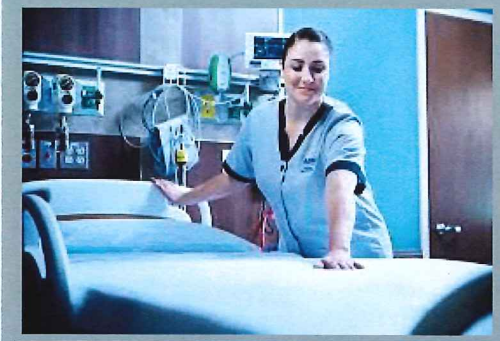
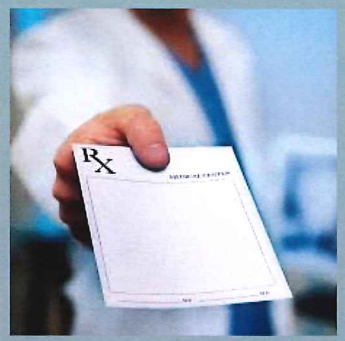
Interval 3 (Discharge): Future State Map



INTERVAL 3



Efficient bed changeover by EVS staff



Prescriptions

MD making decision to discharge or admit

Discharge lounge

Patient being discharged to SNF or back home

IDEAS FOR FUTURE STATE

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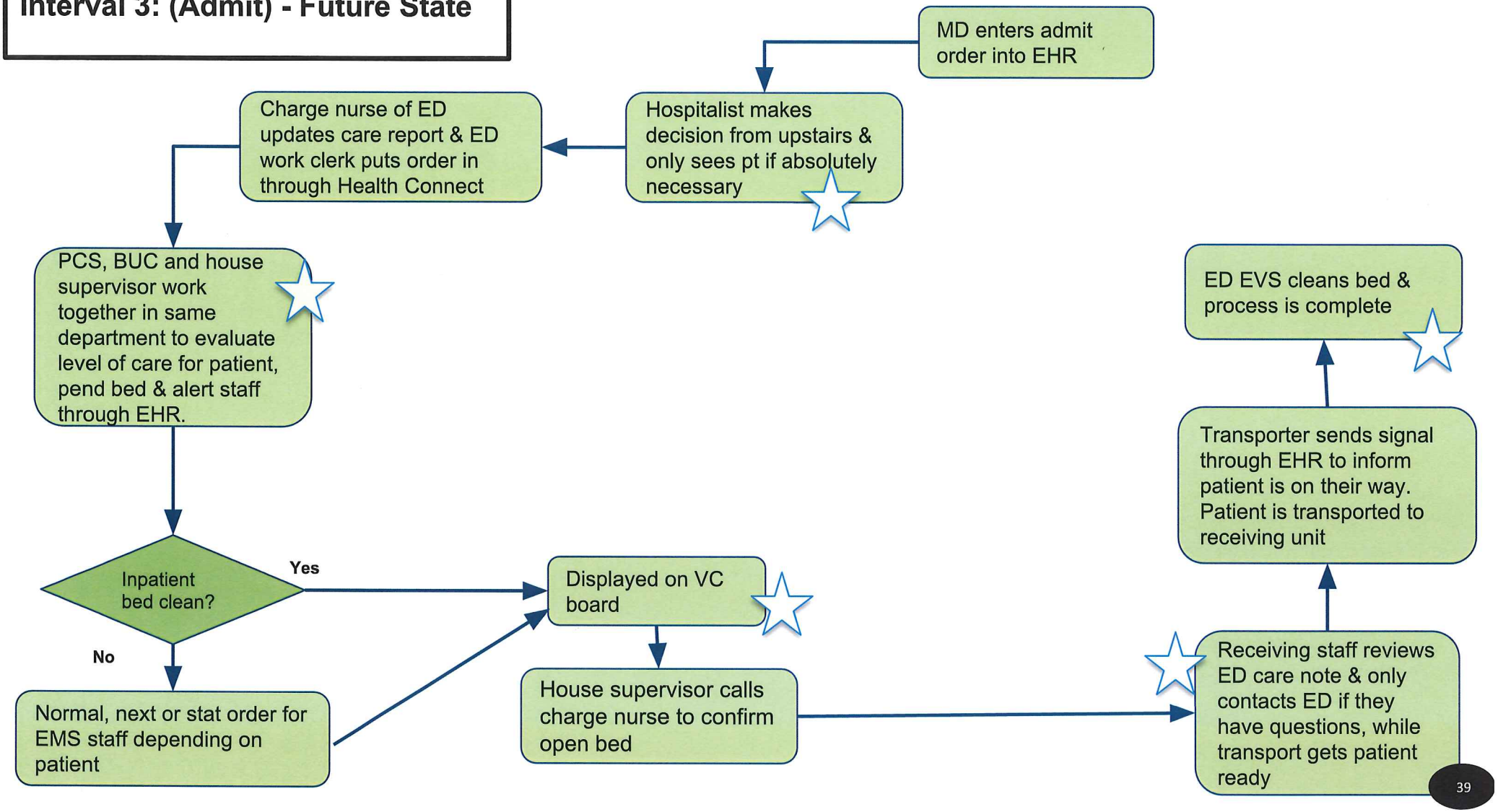
Interval 3: (Admit) - Future State



LEAN IMPLEMENTATIONS (PART 1 OF 2)

1. Standardize front-end triage with a physician and an experienced nurse to immediately assess the severity of the patient

- Decrease the amount of fast track patients going back to main beds & send low acuity patients (ESI 5) straight home
- During slow months pit shift MD moves up front to triage. During busy keep pit & bring additional MD to triage.

2. Minimize the amount of time patients have to wait for radiology testing

- Implement uber like system to call a transporter when the patient is ready.
- Allows ED staff to see where transporter is in the hospital and an ETA.
- Use transporters rather than radiology technicians to increase number of patients receiving tests per hour.

3. Hospitalists & ED physicians should communicate through EHR with greater level of detail

- Hospitalists must not batch patients (15 min max to evaluate)
- Agreement between hospital management and ED to automatically admit ESI 1; and for ESI 2 &3 see nearest computer and make decision without coming down. Only in rare cases should hospitals be involved in ED.

4. Prevent dropping the ball and fragmentation

- Hire a "Patient Advocate" to track entire flow of each patient through ED and take responsibility away from RNs and MDs
- Hire scribe for busy seasons to reduce time MD writes chart for patient & give them more facetime with their patients.

5. Implement visual controls to indicate detailed patient status (arrived, roomed, in FT, ready for MD, assessed, waiting for transfer or treatment or test, in testing, ready to return from lab, ready to be admitted to hospital, sent to hospital, bed ready for EVS, waiting for discharge, etc.) to reduce handoffs

- Have the screens visible in all needed areas of ED, hospital,, testing labs, discharge

6. Efficient room changeovers through EVS staff

- Instead of 1 EVS staff member per shift, increase to 2 so that they can be solely responsible for room changes instead of busy nurses and techs. Still flexibility for 1 EVS staff to go upstairs to help with admit bed

7. Implement a separate charge nurse for each pod, (performing admission, discharge, transfer functions)

- Take over for nurses on their lunch breaks
- Help to decrease nurse overtime hours

8. Identify need for social work or case manager early in patient visit (Specific focus on elderly and psychiatric patients)

- Ensure social work is being proactive on what patients probably will need their assistance
- Contract with a facility for patients to save money on keeping psych patients in ED

LEAN IMPLEMENTATIONS (PART 2 OF 2)

9. Discharge Patients Efficiently to free up ED capacity

- Implement early and proactive communication with family/partners/caretakers to ensure efficient discharge process.
- As soon as medical treatment ends, move patients to be discharged outside of ED beds to a dedicated discharge lounge or waiting room.

10. Combine duties of those involved in admits (ie House Supervisor & BUC & PCS) into one individual as sole responsibility to eliminate excessive handoffs within admit process

- Eliminate stress and overwork from ED charge nurse

11. Implement real time communication between laboratory and nurses through Visual Control boards

- No need for ED nurses to call the lab
- Practice preemptive rainbow draws for most patients - unless rare counter-indication
- One dedicated phlebotomist ED 24/7
- Amend EHR with Visual Controls to notify staff of lab status

12. Ensure evidence based guidelines to avoid excessive testing while maintaining a balance between Patient Satisfaction and their safety

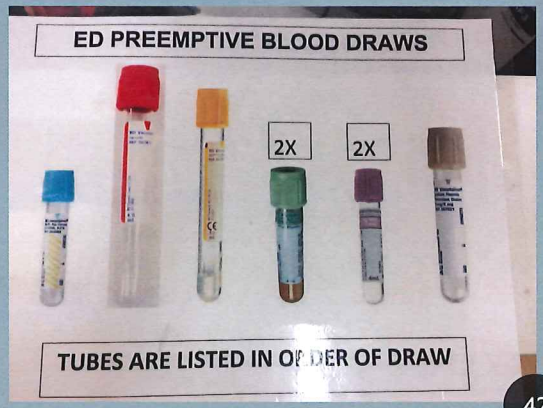
- Leadership of ED creates culture of safety so that junior doctors do not fear job security when practicing
- Utilization of app aids
- Allows physician to put in patient's symptoms and shows patient whether or not they are in a danger zone

13. Stock supplies that are frequently used and lower in cost in convenient locations, so nurses do not have to walk long distances to fetch supplies while tending to a patient

- Consider investing in one or two more transportable x-ray machines for ED use
- 5S (sort, set, shine, standardize, sustain) to locate supplies easily.

OVERALL BENEFITS

- More face time with patients
- Increased staff morale
- Decreased time waiting for radiology tests
- Elimination of time between RN triage and MD assessment
- Elimination of defects on front end
- Low acuity patients taking up fewer beds
- Minimize overproduction of lab tests and cuts costs
- Improved patient safety
- Reduction of idle states
- Minimize handoffs
- Inventory improvements
- Less unneeded movement while working with patient

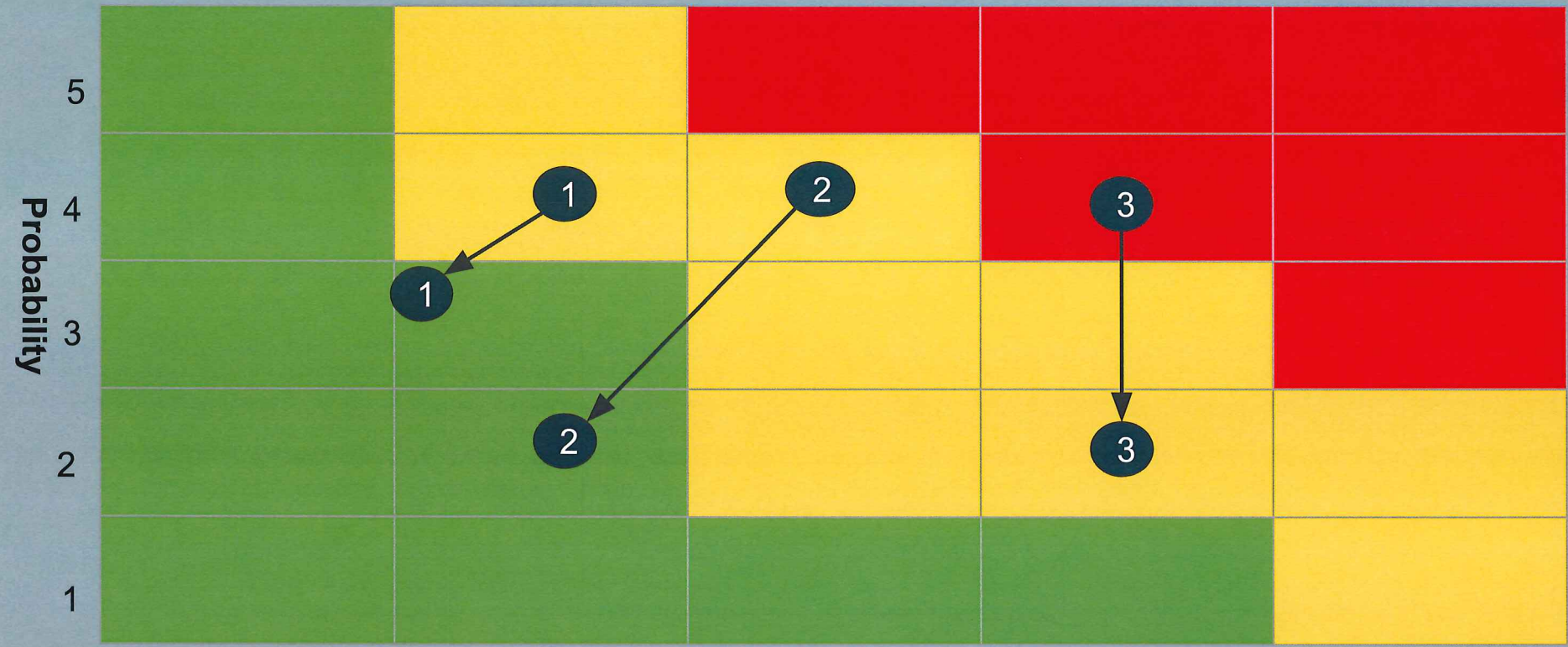


RISK ANALYSIS

#	Risk Title	Description	Mitigation
1.	Staff reluctant to changing ways.	Often time healthcare professionals are comfortable and confident in their ways and do not think changing will make a difference.	Better leadership, training and understanding of Lean through Kaizen events
2.	Union challenges	Kaiser Permanente respects union laws	Train, involve and empower workers into decision process
3.	Potentially high initial costs	Visual Controls, additional radiology machines, and higher staffing	Prepare a business case for long term savings and revenue

RISK ANALYSIS

Green - low risk
Yellow - medium risk
Red - high risk



BUSINESS CASE

WHY DO WE NEED TO CUT DOWN PATIENT'S TIME IN ED?

ED average cost per patient visit & day	Inpatient costs per day:
$154.33 per hour ($463 for about 3 hours (avg time from door to discharge))	ICU - $2,400 → $100/hr DOU - $1,500 → $62/hr TELE - $1,300 → $54/hr Med / Surg - $1,200 → $50/ hr

Average Cost / ED Patient	**$463.00**
Estimate Average Cost of Patient/ Hour (Discharge)	**~$154.33** ($463 / 3 hrs = average cost of outpatient service / average door to discharge time)
Estimate Average Cost of Patient / Hour (Admit)	**~$84.18** ($463 / 5.5 hrs = average cost of outpatient service / average door to admit time)

The cost per hour per patient is much higher in ED than the inpatient cost and thus reducing each patient's LOS in ED is crucial to cutting costs.

<u>Focus on the most frequent and largest bottlenecks first when deciding what to prioritize for implementation:</u>

- Radiology Testing
- Inadequate staffing
- Admitting process for patient
- Psychiatric patients on "5150 case" holds stay in the ED for 72 hours or longer
- Elderly patients waiting for SNF approval

Martin Chan, Orange County Finance Manager, 2016

BUSINESS CASE (CONTINUED)

Additional CT or x-ray machine (most frequently used)	- Premium CT scanner (128 slice system) or IR machine just for ED use = $250k to $700k - This will reduce each patient stay on average by 40-60 minutes, therefore average cost per patient saved will be ~ $100-154 (1 hr in ED = ~ $154.00) - (67,798 pts in 2016 → ~ 73.6% main patients = ~49,892 patients in main (73.6% of 67,789) → estimated ~ 40,000 patients receive radiology testing as not all patients in main do) = roughly $4,000,000 saved for 1 year - **Simple Payback Period = IC/AS ($600,000 / $4,000,000/ 1 yr) = .15 years**
'Patient advocate' to track patient status	- Saves ~20 mins for each patient (MD and RN do not have to constantly call radiology or lab) - Min wage -minimum wage and works 12pm-10pm (peak hours) = ~ $735 (7 day week) * 52 weeks = ~$38,000 - 20 mins * 67, 000 patients per year = Saves 2,233 hours per year of tracking - **Benefits:** Decrease burden of busy RNs, and MDs, and decrease LOS of patient in ED
Transport assistant for radiology technician during peak hours only	- Radiology tech estimates they can see 6x patients an hour instead of 2 without having to transport patient - Transporter assistant - minimum wage and works 12pm-10pm (peak hours) = ~ $735 (7 day week) * 52 weeks = ~$38,000 - Saves radiology tech 30 mins/ hr on average and allows patients LOS to decrease about 30-60min = ~$70-$150 per patient - $110 * ~40,000 patients that receive radiology per year (above) = ~$4,400,000 saved - **Benefits:** Patient safety is increased, LOS decreased, and radiology techs can perform tests more efficiently and effectively

The upfront cost of the above suggestions (buying CT or x-ray machines, additional staff, implementing Uber software, etc.) are significant and understandably difficult to accept without good ROI.

However, these improvements should be viewed as an investment in Kaiser Permanente's brand. The reduced wait times will increase patient satisfaction, and build on Kaiser's already great reputation.

LEAN IMPROVEMENT SUMMARY

	Current State	Future State
Total Time (Admits)	Baseline	↓ ~10-15% (estimated)
Total Time (Discharges)	Baseline	↓ ~15-20 % (estimated)
Cost Benefits	Baseline	↓ ~ 10-15% (estimated)
Access	Baseline	↑ capacity
Frustrations of Staff	Medium to high	Low to medium

Data based on Gemba walks with health care staff and estimated calculations

CONCLUSIONS

- As expected, the improvement ideas from Systems Engineering and Lean methodologies applied to the ED Kaiser Permanente Anaheim project cut down waste and added value added time to the overall process.

- Due to academic time constraints metrics of effectiveness were not able to yet be completed. Project at Kaiser Permanente will continue until June and the project will be updated afterwards.

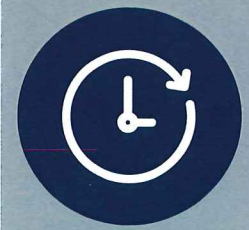
LOOKING AHEAD

- Meetings with PCS and admit team
- Communication methods consolidation
    - Examination of various modes used

      - ie: Vocera, phones, pagers
- SNF and psychiatric data analysis
- Evening Gemba Walks

WHAT I'VE LEARNED

- Communication and human factors play into healthcare much more than expected. As a healthcare system engineer it is important to build systems around the user and patient. Empathy is a key element in any design thinking.



- Not all delays can be eliminated, so hospitals should identify areas where improvement is in fact possible.

- Even within a highly successful organization that already has made numerous improvements, opportunities to do better always exist. Each new attempt finds more waste and more opportunities to improve.

ACKNOWLEDGMENTS

All individuals from KP unless noted otherwise
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Dr. Bohdan Oppenheim, LMU
Marie Coley, RN
Danielle Bergen, RN
Margie Harrier
Lindley Garcia
Michelle Dawtyler
Paul Mociler
EVS Staff & Alex Ivy (EVS manager)
Anaheim Case Manager
Sandra de la Cruz, Social Worker
Cecilia Militante
Phlebotomist Staff
Pharmacy Staff
ED Technicians
Radiology Technicians
KP Sponsor, MSAAT

thank you!

APPENDIX

EXECUTIVE SUMMARY

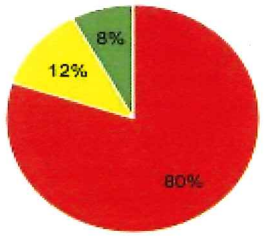
- An Emergency Department is a chaotic and fragmented environment due the many stakeholders and departments that must effectively work together to treat each unique patient while also attempting reduce the overall length of stay.

- This project was a successful attempt to eliminate waste in the Anaheim ED, through Systems Engineering and Lean Methodology. Thorough analysis was done through gemba walks, process mapping, risk analysis, business cases, and Lean improvement analysis which show an overall decrease in waste, cost reduction, and an increase in accessibility by patients and staff morale.

VALUE ADDED TIME vs WASTE

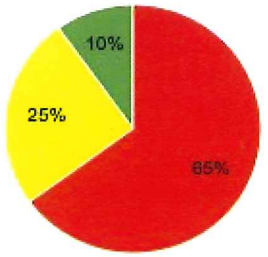
Red = waste
Yellow = necessary, non value added
Green = value added

Current State Admits

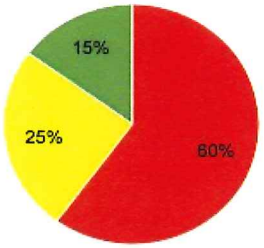


Greater waste in admits due to delays in hospitalist & inpatient bed availability

Current State Discharges

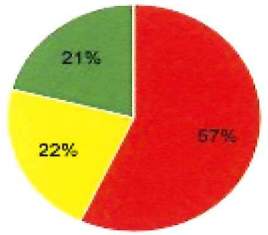


Future State Admits



Waste due to variability in MD workflow, diagnostic tests, lack of resources, discharge process(PT approval for SNF, etc.), stabilization of patient.

Future State Discharges



Data based on Gemba walks with health care staff and estimated calculations

METRICS OF EFFECTIVENESS

Measure of Effectiveness (MOEs)
Defect reduction
Capacity Increase
Quality
Time reduction
Morale where relevant
Cost reduction
Economic Analysis